DOCUMENT RESUME

ED 477 841 SE 068 010

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TITLE	Schooled and Community Numeracies: Understanding Social Factors and "Under-Achievement" in Numeracy.
PUB DATE	2000-00-00
NOTE	10p.
AVAILABLE FROM	Web site: http://correio.cc.fc.ul.pt/~jflm/mes2/ baker.doc
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Early Childhood Education; *Family Role; Foreign Countries; International Studies; *Low Achievement; *Mathematics Education; *Numeracy; *School Role; Social Influences
IDENTIFIERS	United Kingdom

ABSTRACT

This is a discussion of research in the 'Schooled and Community numeracies focus within the Leverhulme funded Low Educational Achievement in Numeracy Research Programme. The intentions of the research in this focus are to seek explanations for underachievement in numeracy that derive from understandings of mathematics as social. We wanted to understand why some children apparently cope easily with informal numeracy practices whilst others struggle with formal numeracies. We wanted to investigate boundaries children face or which are constructed between home and schooled numeracy practices. The paper will initially consider some of the conceptual and methodological issues that have arisen in the research. Work done in a pilot study will be used to throw further light on these issues and possible implications for both research and schooling will be raised. (Author)

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Schooled and Community Numeracies: Understanding Social Factors and 'Underachievement' in Numeracy

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Schooled and Community numeracies; understanding social factors and 'under-achievement' in numeracy.

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Abstract

This is a discussion of research in the 'Schooled and Community numeracies' focus within the Leverhulme funded Low Educational Achievement in Numeracy Research Programme. The intentions of the research in this focus are to seek explanations for underachievement in numeracy that derive from understandings of mathematics as social. We wanted to understand why some children apparently cope easily with informal numeracy practices whilst others struggle with formal numeracies. We wanted to investigate boundaries children face or which are constructed between home and schooled numeracy practices. The paper will initially consider some of the conceptual and methodological issues that have arisen in the research. Work done in a pilot study will be used to throw further light on these issues and possible implications for both research and schooling will be raised.

1 Introduction

This paper is a discussion of one part of the Leverhulme Numeracy Research Programme (1997 – 2002) investigating Low Educational Achievement in Numeracy in the United Kingdom. The intentions of the programme are to contribute to: understanding of the critical points in progression in primary mathematics; knowledge of how classroom practices affect attainment; identifying training and intervention strategies; understanding teacher change; understanding the effects of social factors. This paper will concentrate on the latter aspects, which form focus 4 of the programme on *'Schooled and Community Numeracies'*. The team of researchers working on this focus are Dave Baker from the University of Brighton, and Brian Street and Alison Tomlin, from Kings College, London. The intentions of the research in this focus are to seek explanations for underachievement in numeracy that derive from understandings of mathematics as social. The reasoning behind this approach is that research on, and educational policy for, raising achievement in numeracy has recently mainly focused on aspects such as teacher subject knowledge, pedagogy (pace, style, whole class teaching, setting, calculators, homework), schools (leadership, effective management, policies), and educational structures (assessment regimes and systems, Local Education Authorities). Consideration of the effect of social factors on the other hand have been marginalised and even rejected despite serious research exposing their significance. For instance:

> "The data from the National Child Development Survey (1991) show that there is a strong relationship between children's performance in maths and reading tests between the ages of six and eight and their parents' earnings, with the children of higher earning parents performing better." (Machin, 1999 p 19).

and

> "The British Cohort Study shows that at 22 months the children of parents in social classes one or two with higher education levels are already 14 percentage points higher up on the educational-development distribution than children whose parents are in social classes four and five and have low educational achievement." (HM Treasury, March 99, p 29)

Macro visible social factors like poverty clearly do play a large role in educational achievement. In terms of numeracy we wanted to focus on less conspicuous social factors. We wanted to understand why some children apparently cope easily with formal numeracy practices whilst others struggle often in vain to handle those practices. We wanted to investigate boundaries and

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barriers children face between formal and informal numeracy practices and between home and school numeracy practices. The construction and maintenance of such boundaries and barriers are also considered.

The paper will initially unpack some of the conceptual and methodological issues that have arisen in the research so far. Work done in a pilot study will be used to throw further light on these issues. Implications for research and for teaching will conclude the paper.

2 Conceptual issues

The objective of looking at mathematics as 'social' is to understand and describe different meanings that pupils bring to their encounters with schooled maths/numeracy and thereby to contribute to explanations for the underachievement of many in schooled maths. This includes developing a language of description and refining lenses for viewing maths practices in social contexts that might complement and enrich the current tools for description available in the field. The concepts we needed to clarify were therefore: understandings of numeracy as social; the nature of community and schooled numeracies: and home/community/school relationships. A great deal of work in the field of 'social literacies' has addressed many of these issues. One dimension of the research is to consider how far this social literacies work (cf. Street, 1996) can be applied to the field of mathematics education.

The first aspect we needed to clarify was the social in mathematics and numeracy. (c.f. Baker BCME 99). A social perspective on mathematics does not entail simply privileging everyday or 'ethnic' mathematics or treating everything as 'social', which can be rather vacuous. Nor does it entail pronouncing on the ontological status of mathematics. Rather it provides a vehicle for an exploratory inquiry into what follows from considering mathematics as social practice. In my research, (Baker,1999), into this question I found that understanding numeracy or mathematics as 'social' tends to be understood in strikingly different ways in educational contexts. The dominant model was a narrow view of the social in numeracy. It was expressed in terms of interactions with others or of numeracy being seen as useful or functional. I proposed a different, broader view, which saw the social in terms of ideology and discourse, power relations, values, beliefs, social relations and social institutions, (Baker, 1999). Here, 'values and beliefs' feature in choices made and in contexts in which numeracy is sited. The contexts of home and school are very different and I wish to understand the extent to which the numeracy practices sited within them are different. By 'social relations' I mean our views of ourselves and others and how we represent ourselves to each other in terms of numeracy practices. We take on various roles and identities. We therefore position ourselves as insiders or outsiders and feel either part of the community of practices or alienated from that community. 'Social institutions' and procedures are to do with issues of control, legitimacy, status and privileging of some practices over others in mathematics. This results in accepted and dominant paradigms and procedures, which remain uncontested. A narrow view which is based on an autonomous model of numeracy as described by Baker and Street, (1996) and notions of accepted pedagogy and curriculum (cf. DfEE, 1999c), leads to blaming failure or underachievement in numeracy on the teacher, the child or the home and seeing them in some sense in deficit: the teacher in terms of her subject knowledge or her use of ineffective teaching practices; the child in her lack of skills, knowledge and understandings; and the home as lacking adequate understanding of schooled numeracy to support their children (Freebody and Ludwig, 1996). Ideology underpins all these perceptions and views which are revealed in the discourses (cf. Gee) that occur around them. The broader social model, which makes the epistemological and ideological explicit (Baker and Street 1996), provides different ways of viewing and understanding underachievement and could lead to policies that go beyond access and empowerment towards transformations of curriculum and pedagogy. Instead of viewing underachievement in terms of deficit in dominant practices the model accepts social notions of

difference and multiple practices and seek to represent and build upon informal numeracy practices and funds of knowledge, (Moll, 1992).

One concept that flows through the above discussion and through our work is that of numeracy practices. As has been discussed elsewhere, (Baker, 1996), and in parallel to literacy practices, (cf. Street, 1996), we see numeracy practices as more than behaviours that occur when people do maths. We propose that numeracy practices include the conceptualisations, the discourse, the values and beliefs and the social relations that surround these activities as well as the context in which they are sited. The concept of numeracy practices is grounded in the broad notion of the social in maths and is a central concept in our research. It provides a language of description and a lens through which to view practices in different contexts, and leads to an acceptance of multiple numeracies, each one framed and sited in the context in which it occurs. To complement this concept we use the more contained idea of numeracy events, in parallel to literacy events (cf. Street, 96), to denote any occasion when mathematics is used, (Baker, 1996).

We are particularly interested in relationships between home/community numeracy and schooled numeracy practices. These relationships are about ways these practices are the same or different, the boundaries between them and the ways they are viewed. Work on the former can be seen in the work of Massingila et al (1996), Baker (1996) or Abreu (1995). It is argued that these numeracy practices are different because of the context, the values or the discourses in which they are sited. It is suggested in these articles that no set of practices is superior but that they are different. On the other hand, it is also clear that each is constructed and viewed quite differently. Schools and educational policy privilege schooled numeracy over home practices. They see the relationships between them as unequal with the role of homes subservient to that of schools and the boundaries between them clearly delineated. Homes are places where, if possible, the numeracy practices of the school are to be practised and reinforced. Homework is set by the schools and the role of the home is to assist the children's schooled numeracy activities. In an article in the Education Guardian about the National Numeracy Strategy, (NNS), Ebbutt (1999, p 2) wrote:

> "The National Numeracy Strategy promotes informing parents fully, so that mathematics at home can support mathematics in the classroom"

In a document on the National Numeracy Strategy the DfEE states:

> "An important part of the NNS is that parents are involved and well informed about their children's learning at school. Before parents can help their children effectively with mathematics, they need to understand something of how mathematics is taught in school". (DfEE 1999a).

Formal education views homes as homogeneous with a model of the 'normal' family. Brown (1999) says in his analysis of the IMPACT programme:

> "Initiatives such as IMPACT (Merttens et al, 1990) are frequently presented as a unified programme aimed at a homogeneous group" and "a relatively homogeneous image of 'parents' appears to be shared by teachers".

Tasks set for the children to do at home are based on this assumed homogeneity and on the needs of the school. The DfEE (1999b, p 20) provide sample tasks to be tackled in homes. These assume parental involvement which may not be appropriate for all homes or may even be rejected by some parents. For example, a parent at Mountford School on the pilot project, (cf. account below), when questioned about homework and home based tasks said:

> "the Government has got it wrong. Children have other things to do at home. Maybe they should stay at school for 20 min and finish it off. Then go home and play. My dad used to ask me if I had any. I would say no so I could go out and play". (6 July 99)

An alternative view which sees the home as possible sites of rich educational resources or as 'funds of knowledge' (Moll, 1992), are not seriously considered. Yet this might in the long term have much to offer as a possible strategy to raise achievement in mathematics.

3 Methodological Issues

In seeking to investigate differences between schooled and home numeracies and other relationships between home and school we needed to study events in classrooms and in schools in some depth. In the light of this we based our work on detailed case studies. This threw up some key methodological issues: firstly, selection of schools and individual children; secondly, accessing home practices; and thirdly, obtaining parental agreement for opportunities to engage with the families in home numeracy practices. The development of a language of description for identifying and categorising mathematics and numeracy practices in both schooled and community contexts is an issue as well as deciding what precise practices and data the research would seek and collect. We needed to develop case studies of home practices and decide on the balance of interviewing and observing. Some of these issues are discussed below others are raised in the account of the pilot fieldwork.

The sites for the case studies have been chosen to be contrastive, 'telling' cases (Mitchell 1984). The criteria for selection enable us to cover, where possible, the main dimensions of suspected heterogeneity in the population. We selected three schools according to social features frequently cited as significant for achievement in schools. These were location (Freebody et al 1996), ethnicity (Jones, 1998), and relative affluence (Machin, 1999). One of the schools is in a mainly 'white', affluent suburb, the second has a 'white' socially deprived catchment area, and the third is in a mixed urban area attended by predominantly 'black' children. Four children will be chosen initially from one class in each of the three schools, a total of 12 children. The children will be recruited from reception classes, as nearest in social influence to the home environment, and followed through reception to years 1 and 2. The children will be selected in consultation with the teacher. To suit our contrastive methodology we will seek children with the greatest differences in home/school relationships. This may prove difficult in practice and we may use attainment as an indicator of these differences and to give us a contrast in the successful or relatively unsuccessful negotiation of boundaries and barriers between home and schooled numeracies. However, a substantial constraint on selection will be the agreement or non-agreement of parents/carers to be part of the research.

Data will include: field notes from observations of school lessons, home numeracy activities and 'community' numeracy practices and events amongst pupils from these schools; collections of work and texts used in those contexts, including official curriculum documents, course documents, 'homework', teacher feedback materials; documents regarding home/ school links; audio-recorded interviews with teachers, parents and pupils. We are also drawing upon documents on home/school relationships from the NNS. The balance of school and home visits will need to be flexible as it will build reflexively on previous visits and will depend on access to homes.

4 Pilot fieldwork.

The purpose of the research was to investigate relationships between home and schooled numeracy practices. Our concerns about conceptual and methodological issues led us to try ideas and methods in a pilot phase in order to hone our concepts and methodological principles. In particular we wanted to try and get access to homes and schools to alert us to possible strategies and problems for such visits and to think about the responses of parents and teachers to the research. In particular we wanted to refine our methods of data collection and observation in both classroom and homes in the light of such responses. What follows is a description of the pilot work we have been doing together with a vignette from the pilot to illustrate conceptual and methodological issues.

In the pilot phase in 1998/9, we worked for 6 months with children aged 4 to 5 years old in a primary school serving a 'white' socially deprived housing estate with high unemployment. We have observed and participated in classroom activities, mainly associated with numeracy but unavoidably also associated with literacy. One feature of reception classes such as this is that children are used to a number of adults being present as assistants and the researcher is inevitably drawn into participation, not just observation. We have particularly been interested to focus on classroom activities that might also be similar to those in homes e.g. playing games or using money. Following these classroom observations, our aim was to track selected children into their communities, through contacts with parents made with the help of classroom teachers. During the pilot we were able to visit a child and his mother at home after school. These sessions were arranged through the class teacher but in fact other children were keen to have us visit their homes as well. Occasions such as these have helped us explore methodological and ethical issues involved in such research. In these cases we used an open and unstructured approach to the investigations and sought issues that would shed light on the further enquiries which we plan to conduct in this and other schools over the next three years. We are developing methods that will enable us to investigate issues such as numeracy practices in the home, relationships between home and schooled numeracy, the extent to which schooled numeracy impacts on the home and vice-versa. For example, a focus on the use of games in homes and schools may provide insights into the numeracy practices of the children and to differences between those in homes and schools.

An instance of this kind occurred when I was asked by the class teacher to work with a group on literacy using an game on a number track, like 'Snakes and Ladders'. The track was in the form of a winding snake marked out in square-like sections. In each square section there was a letter. There was a starting square and a finishing square. The first child to reach this end square was the winner. The game involved the children taking turns rolling a die which had from 1 to 6 dots on each face. Players moved their piece the number of squares indicated by the die along the track, beginning from the starting square. When they landed on a square with a letter they had to find something around them beginning with the letter in the square. The next time they rolled the die, they had to start counting from where they had landed previously. The children hardly engaged with the literacy aspects of the game at all. They found the activity hard not only because the literacy skills of finding a word beginning with the identified letter were difficult for them but because they struggled with concepts contained in the game playing and numeracy aspects of the task. Game playing required acceptance and understandings of turn taking, rolling a die, the purpose of the rolling of a die, ways of relating the sign on the die to amount of movement along the track, which direction to move along the track, where to start the count from, which parts of the track counted as a unit, and an interest in or cultural affinity with winning. They had to accept that they had arrived at a square on the number track and had to stay there till their next turn. They frequently wanted to handle and play with their pieces between turns. Notions of numbers and a number track were not obvious to them either. They had problems recognising and counting the dots on the die and relating that number of dots to a number which they had to retain and use to move along the track. This suggested that the numeracy practices that the teacher wanted to draw on for this task included those associated with game playing and with number tracks. One could represent this as a lack of skills and the children as in deficit. Alternatively we could describe this as not being part of the children's cultural assumptions about numeracy practices. The teacher's unspoken assumptions about the children's familiarity or otherwise with game playing and with the numeracy aspects of the tasks may help to explain the children's difficulties or even so-called under-achievements.

The children had met similar games and number tracks in the classroom before. However, it was not clear how this related to their number practices out of school at home or in the community. We decided to investigate the use of games and number tracks at home. When we subsequently visited the home of one of the children it was clear that they had never played games like snakes

and ladders that used many of these game playing, die or number track concepts. This is not to say that they did not play other games. The 4 year old child spent over an hour playing a fantasy game with a model of Godzilla, a very large two legged dinosaur-like creature that was about 40 cm tall. On the ground next to its feet were 3 cm high cars and people made to scale. This model had a wide range of numeracy practices hidden in it including, comparisons of heights, power, size and scale, language as well as fantasy and creativity. When presented with Snakes and Ladders at home he showed little interest. His numeracy practices at home were different from those at school. His practices were not necessarily less valid, less interesting or less powerful. They were simply different. However, the assumptions of schooling are that children are exposed to game and number track numeracy practices at home and that homes where children do not meet such activities are in deficit. In this case it meant that a child from this particular home was unable to engage fully in the literacy task set for him because for him home and school practices were clearly at odds with each other. That is, the boundaries between these practices were very substantial for some children and could be less so for others.

Experiences in the pilot study established some methodological practices that we would need to follow. For example we may have to engage with the children fully in their activities in the classroom, and not remain detached from these interactions. From the pilot it seemed that access to homes may remain problematic but could be achieved using both the teacher and the children as a means of introduction. However, longer periods of access over three years as is intended in the project may depend more on being seen to provide homes with aspects of formal educational value in return, (Civil, 1999). Access to schools and teachers seems less problematic. They have remained positive about the work we are doing, mainly because home/school links are currently high on their agendas, although they may request feedback relating to these agendas in return. In the case of the pilot school they have welcomed us back next year for the substantial phase of the project.

Issues about home/school relationships may revolve more around teachers' expectations and images of homes. Some teachers, in parallel with others in education, seem to have a deficit model of homes. They see some homes as unable to contribute significantly or effectively to their children's education and do not see possibilities for building on 'funds of knowledge' from the home communities. Teachers seem to have conflicting expectations of homes. On the one hand they have this deficit model of homes and see homes particularly from low socio-economic backgrounds as unable to support the kinds of numeracy practices they would welcome in their classes. On the other hand, they assume that children's numeracy practices outside the school are the same as of those in formal schooling so that games like snakes and ladders can be used without further explanation. Alternatively, some reject home practices altogether as in the deficit model (cf. Rowland, 1999), either irrelevant or non-existent and do not allow them to influence their curriculum or pedagogy. In a parallel way, parents/homes and community expectations of schooling are that children will learn formal numeracy practices at school and that children's informal or non-schooled numeracy practices will not be of value in the classroom. The differences between these views of what counts as numeracy and the practices associated with it may go someway to explaining difficulties some children have in moving from home to school. The pilot confirmed and extended our concepts of numeracy practices as contextually defined and framed and our belief that there are many different numeracy practices. It also confirmed our models that relationships between homes and schooling are asymmetric with schooled numeracy having a high status and home practices being marginalised.

5 Implications

When researching social factors and classroom practices there are strong expectations and desires for answers to practical classroom issues. This can result in the neglect of research and theoretical issues that may be of value and interest. At this stage in our research we do yet think we have

answers, we are still investigating the situation. However, where there are some initial implications we see them as relating to teaching; research and policy.

For researchers there are different ways of seeing achievement and underachievement in numeracy. From one perspective there is a deficit model where children and homes need to be enabled by teachers to learn dominant numeracy skills. A different social perspective provides understanding of social aspects of numeracies and multiple numeracy practices, the importance of context, social relations and ideology, and social factors in schooled and home/ community numeracies. Instead of the dominance of deficit and hierarchical models of numeracy practices this perspective proposes notions of difference, multiple practices and of funds of knowledge.

In terms of detailed teaching, pedagogical and curricular implications of a broad view of the social in maths remain a complex question. Our reading of research literature suggests that a move to acceptance of maths as social does not necessarily result in changes in ways of teaching maths. There is not a 1-1 causal relationship between epistemological models and pedagogy. We are, however, suggesting, that broader views of the social in maths can lead to greater understandings of classroom interactions and though such understandings to changes in classroom practices. What our data do tell us is that relationships between home and school are complex and the extension of schooled numeracy into homes through homework or parent evenings, though encouraged in official policy statements, may be problematic. Instead a commitment to making use of the funds of knowledge in homes, acceptance of the value of home numeracy practices, investing resources and energy into identifying and understanding such funds of knowledge, in and out of school experiences, may have more to offer curricula teachers and schools than has previously been accepted.

Official government concerns about the access to powerful knowledge such as schooled numeracy, particularly for children from educationally disadvantaged homes, may have to be challenged and replaced by transformations in curriculum and pedagogy rather than only in homes. One implication of viewing mathematics in general and numeracy in particular in this way may be that *both* home and schooling have to change if we are to have any substantive and long lasting affect on achievements in schooled numeracy.

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